

Claims

- [c1] 1.A method of inspecting a sample's surface with an inspection system, comprising the steps of:
 - providing a sample having a surface;
 - providing a non-vibrating contact potential probe;
 - scanning the sample's surface with the non-vibrating contact potential probe by causing relative motion between the non-vibrating contact potential probe and the sample's surface;
 - measuring contact potential difference between the sample's surface and the non-contact potential probe;
 - generating a first signal portion characteristic of a topographical feature of the sample's surface and further having a second signal portion representing chemical features of the sample's surface.
- [c2] 2.The method of inspecting a sample's surface further comprising the step of amplifying the topographical signal relative to the chemical signal.
- [c3] 3.The method of inspecting a sample's surface of Claim 1 further comprising the step of biasing a portion of the inspection system.

- [c4] 4.The method of inspecting a sample's surface of Claim 3 further comprising the steps of:
 - providing a negative bias voltage to a portion of the inspection system chosen from the group consisting of the non-vibrating contact potential difference probe, the sample, and combinations thereof;
 - providing a positive bias voltage of substantially equal but opposite charge as the negative bias voltage to the portion of the inspection system to which the first bias voltage was applied; and
 - subtracting the negative bias signal from the positive bias signal.
- [c5] 5.The method of inspecting a sample's surface of Claim 1, wherein the relative motion is accomplished by rotating the sample about a central axis with the probe tracing tracks of data at varying radii.
- [c6] 6.The method of inspecting a sample's surface of Claim 5, further comprising the step of decreasing rotational velocity in proportion with the motion of the probe to provide the probe with substantially even data density.
- [c7] 7.The method of inspecting a sample's surface of Claim 1 further comprising the step of providing a plurality of non-vibrating contact potential difference probes.

- [c8] 8.The method of inspecting a sample's surface of Claim 8, wherein the plurality of probes are arranged in a linear array.
- [c9] 9.The method of inspecting a sample's surface of Claim 8, wherein the plurality of probes are arranged in a two-dimensional array.
- [c10] 10.The method of inspecting a sample's surface of Claim 8 further comprising the step of providing the plurality of probes at a plurality of heights.
- [c11] 11.The method of inspecting a sample's surface of Claim 8 further comprising the step of providing a voltage bias to the plurality of probes.
- [c12] 12.The method of inspecting a sample's surface of Claim 1, wherein the relative motion is provided by moving the non-contact potential difference probe with respect to the sample which is maintained substantially stationary.
- [c13] 13.The method of inspecting a sample's surface of Claim 1, wherein the relative motion is provided by moving the sample with respect to the non-vibrating contact potential probe which is substantially stationary.
- [c14] 14.The method of inspecting a sample's surface of Claim 1 further including the step of providing a height sensor.

- [c15] 15.The method of inspecting a sample's surface of Claim 1, further including the step of calibrating the height of the non-vibrating contact potential difference probe to measurements made by the height sensor.
- [c16] 16.The method of inspecting a sample's surface of Claim 1, wherein the step of calibrating the height of the non-vibrating contact potential difference probe to measurements made by the height sensor further comprises the steps of:
- positioning the height sensor above a reference surface so that the distance between the reference surface and the height sensor is within a range of detection for the height sensor;
 - recording the height of the sensors as z1;
 - recording the height of the height sensor reading above a reference point as h1;
 - moving the non-vibrating contact potential sensor to a position above the reference point on the reference surface;
 - slowly moving the non-vibrating contact potential sensor down towards the reference surface while monitoring the level of the non-contact potential difference probe signal; and
 - recording as z2 the height when the non-vibrating contact potential difference probe contacts the reference

surface as indicated by a significant change in the output of the non-vibrating contact potential difference probe.

- [c17] 17.The method of inspecting a sample's surface of Claim 16 further comprising the step of positioning the non-vibrating contact potential difference probe at a desired height of h^* by the steps of:
positioning the height sensor above the surface so that the surface is within a measurement range of the height sensor;
recording this height as z_3 and the height sensor reading as h_3 ;
positioning the non-vibrating contact potential probe above the point z_3 ; and
adjusting the height to $z^*=z_3-(h_3-h_1)-(z_1-z_2)+h^*$, wherein the height of the non-vibrating contact potential difference probe is located above the surface of point z_3 at height h^* .
- [c18] 18.The method of inspecting a sample's surface of Claim 1, wherein the sample comprises an liquid crystal panel.
- [c19] 19.The method of inspecting a sample's surface of Claim 1, wherein the sample comprises a semiconductor wafer.
- [c20] 20.A system for identifying features on the surface of a sample comprising:

a non-vibrating contact potential difference sensor;
a mechanism for causing relative motion between the sample and the non-vibrating contact potential difference sensor;
a mechanism for measuring contact potential difference between the sample and the non-vibrating contact potential probe;
a generated signal representing the contact potential difference; and
a generated bias voltage applied to a portion of the system chosen from the group consisting of the sample, the non-vibrating contact potential probe, and combinations thereof.

- [c21] 21. The system for identifying features on the surface of a sample of Claim 20 further comprising a plurality of non-vibrating contact potential probes.
- [c22] 22. The system for identifying features on the surface of a sample of Claim 20 further comprising a height sensor.
- [c23] 23. The system for identifying features on the surface of a sample of Claim 20, further comprising a voltage bias applied to a portion of the system.
- [c24] 24. A system for inspecting the surface of a sample comprising:

a non-vibrating contact potential difference sensor;
a chuck for rotating the sample about a central axis;
the chuck having a variable speed control mechanism for
changing rotational velocity in proportion with the mo-
tion of the probe to provide the probe with substantially
even data density; and
a source of data representing a contact potential differ-
ence between the non-vibrating contact potential differ-
ence sensor and the surface of the sample.